

## **Claims**

- 1) An anaerobic sludge digester comprising:
  - a vessel for containing a volume of liquid, the vessel having a shell with a bottom section with sloped sides; a top section, and a middle section;
  - an upper draft tube with an upper end in the top section;
  - a lower draft tube with a lower end in the bottom section; and
  - a means for pumping liquid through each of the draft tubes.
- 2) An anaerobic sludge digester as recited in claim 1, in which the vessel comprises more than two draft tubes.
- 3) An anaerobic sludge digester as recited in claim 1, in which:
  - jet pumps are provided as the means for pumping liquid through the draft tubes.
- 4) An anaerobic sludge digester as recited in claim 1, in which:
  - the middle section contains cylindrical walls.
- 5) An anaerobic sludge digester as recited in claim 1, in which:
  - the top section slopes inwardly from the middle section.
- 6) An anaerobic sludge digester as recited in claim 1, in which:
  - the vessel is generally egg-shaped.
- 7) An anaerobic sludge digester as recited in claim 1, in which:
  - the draft tubes are axially aligned with each other.

8) An anaerobic sludge digester as recited in claim 1, in which:

    a lower end of the upper draft tube is disposed above an upper end of the lower draft tube.

9) An anaerobic sludge digester as recited in claim 1, in which:

    the digester has a vertical centerline and at least one of the draft tubes is disposed on that centerline.

10) An anaerobic sludge digester as recited in claim 1, in which:

    the digester has a vertical centerline and each of the draft tubes is disposed near that centerline.

11) An anaerobic sludge digester as recited in claim 1, in which:

    the means for pumping liquid through the draft tubes comprises a jet pump.

12) An anaerobic sludge digester as recited in claim 1, in which:

    the means for pumping liquid through the draft tubes comprises a separate jet pump for each draft tube.

13) An anaerobic sludge digester as recited in claim 1, in which:

    the means for pumping liquid through the draft tubes comprises one jet pump for selectively pumping liquid downwards through one of the draft tubes, and another jet pump for selectively pumping liquid upwards through another one of the draft tubes.

14) An anaerobic sludge digester as recited in claim 1, in which the means for pumping liquid through the draft tubes comprises:

means for simultaneously pumping liquid downwards through at least one of the draft tubes and upwards through another of the draft tubes.

15) An anaerobic sludge digester as recited in claim 1, in which the means for pumping liquid through the draft tubes comprises:

means for simultaneously pumping liquid downwards through at least one of the draft tubes and upwards through another of the draft tubes;

means for simultaneously pumping liquid upwards through two or more of the draft tubes; and

means for simultaneously pumping liquid downwards through two or more of the draft tubes.

16) An anaerobic sludge digester as recited in claim 1, in which the digester has a volume in excess of 1.5 million gallons.

17) An anaerobic sludge digester as recited in claim 1, and further comprising an external liquid recirculation system.

18) An anaerobic sludge digester as recited in claim 1, and further comprising:

a middle draft tube with an upper end below the upper end of the upper draft tube.

19) A method for digesting sludge comprising the steps of:

providing a digester that has at least the elements recited in claim 18;

providing a volume of liquid in the digester, the liquid having a surface that varies in elevation; and

periodically pumping liquid downwards through the middle draft tube when the liquid surface rests below the upper end of the upper draft tube and above the upper end of the middle draft tube.

20) A method for digesting sludge comprising the steps of:

providing a digester that has at least the elements recited in claim 18;

providing a volume of liquid in the digester, the liquid having a surface that varies in elevation; and

periodically pumping liquid upwards through the middle draft tube when the liquid surface rests below the upper end of the upper draft tube and above the upper end of the middle draft tube.

21) A method for digesting sludge comprising the steps of:

providing a digester that has at least the elements recited in claim 18;

providing a volume of liquid in the digester, the liquid having a surface;

periodically pumping liquid through at least one of the draft tubes and simultaneously withdrawing some of the liquid and spraying it onto foam or froth on the liquid surface when the liquid surface rests below the upper end of the upper draft tube.

22) A method for digesting sludge comprising the steps of:

- providing a digester that has at least the elements recited in claim 1;
- providing a volume of liquid in the digester; and
- periodically pumping liquid upwards through the lower draft tube and downwards through the upper draft tube.

23) A method for digesting sludge comprising the steps of:

- providing a digester that has at least the elements recited in claim 1;
- providing a volume of liquid in the digester; and
- periodically pumping liquid in a single direction through both of the draft tubes.

24) A method for digesting sludge comprising the steps of:

- providing a digester that has at least the elements recited in claim 1;
- providing a volume of liquid in the digester, the liquid having a surface;
- periodically pumping liquid through at least one of the draft tubes and simultaneously withdrawing some of the liquid and spraying it onto foam or froth on the liquid surface.

25) A method for digesting sludge comprising the steps of:

- providing a digester with an upper draft tube and a lower draft tube;
- providing a volume of liquid in the digester, the liquid having a surface that varies in elevation; and
- periodically pumping liquid through at least one of the draft tubes when the liquid surface rests below the upper end of the upper draft tube and above the upper end of the lower draft tube.